

# Smart Surveillance System

Shantanu Vikas Advirkar<sup>1</sup>, Prachi Vishwas Bhatkar<sup>2</sup>, Neha Suresh Katke<sup>3</sup>, Debarati Ghosal<sup>4</sup>  
<sup>1,2,3</sup>Student, Department of Information Technology, Vidyalkar Institute of Technology, Mumbai, India  
<sup>4</sup>Professor, Department of Information Technology, Vidyalkar Institute of Technology, Mumbai, India

**Abstract:** The smart surveillance system project deals with the implementation prospect of a real-life embedded surveillance system which is based on a raspberry pi module where the android application and the raspberry pi are the two end devices that will communicate with each other. In this design, we have merged two of the main security modules together, intrusion detection and smart door lock. The core element of the proposed system is raspberry pi and its operating system. Raspberry pi camera monitors operate and grants access in this associated design. It captures the real-time images, performs the face matching algorithms based on pixel patterns, initiates live streaming video services as per the client requests and grants and revokes the access of entrance as per the result of face detection and recognition operations. Tracking, pattern matching and image processing with pixel threshold play a huge part in this. All the current security systems run on similar kinds of principles, but they require a large amount of storage for that they subscribe to cloud and other services, strong internet services are required for cloud and flexible other resources. Smart Surveillance System is developed end-to-end to maintain the CIA principle of Information Security so that the user feels secured about his or her private data. This Raspberry Pi based Smart Surveillance System presents the idea of monitoring a place in a remote area. The proposed solution offers a cost-effective ubiquitous surveillance solution, efficient and easy to implement. The main advantage of this system is that it can be handled well from many different remote locations.

**Keywords:** Surveillance, Smart door lock, Image Processing, Pixel patterns, Pixel thresholds, Live streaming.

## 1. Introduction

In today's world, technology has become an integral part of our lives. Everyone has their hands-on technology in every aspect. But because of this, security has become the main issue. Even though security measures involve a lot of technology, attackers or intruders still manage to breach it. Because the attackers have also become experts in using technology for doing illegal activities without getting caught.

Now in days, most of the houses have working parents or guardians. It makes a little bit difficult regarding the security of your home. Everyday many people come to our houses every now and then. If there are small kids or elder people are at home alone, their security becomes the main issue as it is easy to get access from the door because it is hard for them to get to the door every time. This is when a smart surveillance system will come into the picture. Even though there are many similar kinds of security systems and CCTV systems are available in the

market, this system is the combined product of the surveillance system and a smart door lock.

Basically, the smart surveillance system is programmed to detect the intrusion and scan the faces to check whether it is already in the database or not (saved images by admin using a face recognition algorithm). If yes, then the further process is carried out like door unlock and the user enters at home without insider's permission. A door lock is dependent on the face recognition algorithm. According to the algorithm if the face is detected the door will unlock and the user is notified or if the user is not registered then the admin will be notified that someone came please take further action. The response from the admin will be in the text message which is then converted by an algorithm into speech and the speaker speaks out.

This means we cannot find out the person in front of the door, whether he or she is a family member or any other person and according to that whether we should open the door or not. And all these decisions can be taken by the application user from the remote places automatically. All these activities take a little bit of time to give accurate results. This system is well protected and guarded as it has only one admin and he or she can monitor it by using web application which will be installed only in the admin's device. Also in this, there is no need to physically open the door lock as it will be opened automatically through stepper motor which is configured with server i.e. Raspberry Pi. By doing this, we will surely control a lot of robberies and security breaching regarding people's personal properties.

### A. Problem statement

Now in days, people find too much difficulty to secure their surroundings. Even though it is a digital world and a lot of technical options are available, thieves and intruders have also become technologically smart. Few clicks and then the intruder can get access to your system. Therefore, we are building a system that is a lot stronger in every aspect. This system has only one admin and he or she can control the system from remote places. Also, the security provided by the system will be better than the previous ones since we are blending two modules i.e. intrusion detection and smart door lock into one entire project.

## 2. Literature survey

Now in days, many people or groups of people come up with the ideas of advanced security systems. Some of these are still

in progress while some are already implemented successfully. All these ideas differentiate with each other with respect to design, cost, environment, techniques, resources, etc.

An embedded home surveillance system that assesses the implementation of a cost-effective alerting system based on small motion detection was presented by Plasmasphere A. Shake and Sumedha S. Borde. They built this entire system in favor of low cost, low power consumption and remote control which can be handled by anywhere through the microcontroller is compared to other systems.

D. Jeevanand worked on designing of video capture system using Raspberry Pi with networking features. The proposed system captures videos and distributes with networked systems as well as alerts the administration person via SMS alarm when needed. Their system was created to work in a real-time situation and based on raspberry pi. In contrast to other embedded systems, their real-time application offers client video monitor, alerting module, SBC platform, SMS notification, and intrusion detection.

Sneha Singh and his team have built a Video Surveillance system using Raspberry Pi technology. They designed the system in such a way that it will capture the real-time images one by one and will display them on the browser with the help of TCP/IP protocol. They have also implemented a live streaming video option along with the face detection and recognition algorithms, but they have done the research on quite a basic level.

Mahima F. Chauhan and Gharge Anuradha offered to design and develop a real-time video surveillance system based on embedded web server Raspberry PI B+ Board. This application system provides better security solutions because their system has low cost, good openness, and portability and is easy to maintain and upgrade. This system is beneficial to use at high-security places like national banks, military, and political headquarters.

Jadhav G. J suggested a cost-effective surveillance system in 2014 with the use of various sensors, wireless module, microcontroller unit, and fingerprint module. They all used an ARM core as a basis processor of the system. PIR sensor is used to detect motion in the vision area while the vibrating sensor is used to sense any vibration events such as the sound of breaking. The intruder detection technique is proposed by using the PIR sensor that detects motion and triggers a system of alerting and sending short message service through the GSM module for a specified phone number. Their work can be featured by adopting numerous diverse kinds of demanding database and thus it will be more secure.

### 3. Proposed system

Our system design comprises of two parts: hardware design and software design. And The block diagram of the system is in Fig. 1. As the system block diagram shows, we can see the entire system interfaced with each other. The integral part of the system must be raspberry pi model 3B which monitors the

entire system while interacting with raspberry pi camera, PIR sensor, Notification application as well as stepper motor.

#### A. Hardware design

In hardware part of our project, we are intrusion detection part and smart door lock with some main components and will interface them with each other. For intrusion detection, we will connect PIR sensor with raspberry pi model 3B which will send the signal if the human activity is detected in front of the door. After the human alteration detected, to capture it, a raspberry pi camera is fitted beside the raspberry pi. It will capture the images, or it can start the live stream. Also, for extra purpose, there will be a mic and speaker module to communicate with the owner through application which will convert a speech to text and store it in application log.

For the door lock, we will be using a stepper motor, which will move in 180 angles to grant the access to the person based on the admin's order.

#### B. Software design

In this design, we have written a program in python using an integrated development environment(IDE) Python OpenCV.

Also, we have developed our very own application for the database and the notification purpose. This application will be saved in the admin device and it will get a pop up whenever there is a person in front of the door. Also, for storage purposes, we are going to use local storage for all the faces detected which are not in the face recognizer dataset i.e. which are new to the system.

### 4. Methodology

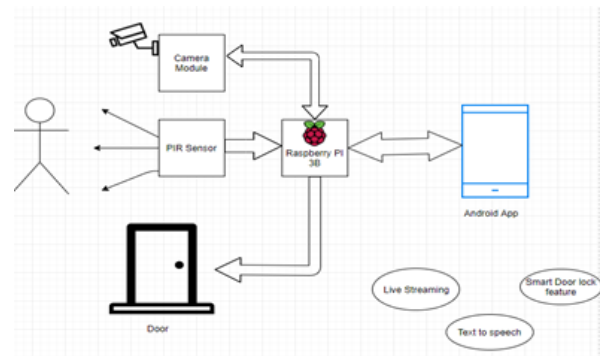


Fig. 1. Block Diagram

In this system first the intrusion detection system which comprises of raspberry pi model 3B, PIR sensor and PI camera will be implemented outside the door. Additional modules of mic and speaker are attached to it. When the person comes in front of the door, the PIR sensor senses the human activity and alerts the raspberry pi about it. PI then orders the pi camera to capture the image or start the live stream as well as it sends the notification to the admin about the intruder. PI gathers the images of the intruder from the different angles and compares them with the pre saved ones in the database. If they match, it gives order to stepper motor to grant the access and then it

moves into 180 angles to give access and if the image differs then the stepper motor stays still at the door and the access will be denied.

The linear working of our project can be explained in the following manner (Refer figure 2):

Step-1: Detect the human activity via PIR sensor.

Step-2: Notify raspberry pi, activate pi camera and capture the images.

Step 3: Compare the images with the stored images in the database.

- Step-3.1: If they match, grant the access to the person via stepper motor on the lock.
- Step-3.2: If the images don't match, reject the access and the door remains unlocked.

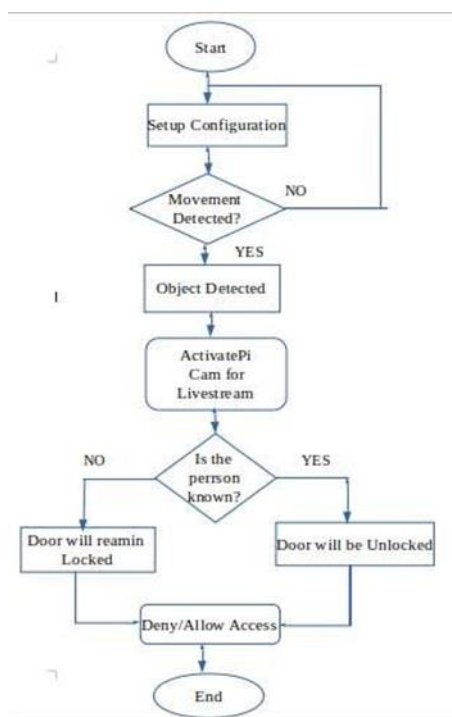


Fig. 2. System Flowchart

### 5. Conclusion

This paper presents a prototype of newly improved smart surveillance system. We exhibited the working of the system, along with the hardware design and software design. And we have implemented many excellent images capturing, intrusion detection, pattern matching and notification alert protocols. This system can detect, recognize and capture the images of the outsider person and by doing some research can conclude whether the person is regular or any unwanted person and whether we should give him or her access or not. We are going to improve the efficiency of the system by speeding the pattern matching process, by providing more accurate results and more security.

### References

- [1] Z. Sundas, "Motion Detecting Camera Security System with Email Notifications and Live Streaming Using Raspberry Pi."
- [2] F. Wahl, M. Milenkovic, and O. Amft, "A distributed PIR-based approach for estimating people count in office environments," in Proc. IEEE 15th Int. Conf. Computer. Sci. Eng. (CSE), Nicosia, Cyprus, Dec. 2012,
- [3] F. Erden, A. Z. Alkar, and A. E. Cetin, "A robust system for counting people using an infrared sensor and a camera," *Infrared Phys. Techno*, Sep. 2015.
- [4] J. D., "Real Time Embedded Network Video Capture and SMS Alerting system," Jun. 2014.
- [5] S. Sneha, "IP Camera Video Surveillance using Raspberry Pi.," Feb. 2015.
- [6] F. C. Mahima and A. Prof. Gharge, "Design and Develop Real Time Video Surveillance System Based on Embedded Web Server Raspberry PI B+ Board," *International Journal of Advance Engineering and Research Development, NCRRET.*, pp. 1-4, 2015.
- [7] Sharma, Rupam Kumar, et al. "Android interface based GSM home security system." *Issues and Challenges in Intelligent Computing Techniques (ICICT)*, 2014NInternational Conference on. IEEE 2014.
- [8] De Luca, Gabriele, et al. "The use of NFC and Networks (SoftCOM)," 2013 21st International Conference on. IEEE, 2013.
- [9] A. D. Osama, "Cisco IP Video Surveillance Introduction," Cisco Expo, 2009.